ment to him than a key to the classification adopted ; it would probably be an improvement if, in future volumes, the author would prefix to these names the terms "Family," "Sub-Family," "Group," &c., so as to allow the systematic value of the names themselves to be more readily appreciated. The two plates accompanying the volume are intended to give an idea of those structural characters on which the classification used in the work is based, and they also give three figures of larvæ borrowed from Schiodte ; it may be hoped that these latter extraordinary forms may incite some student to continue the work of investigating the earlier stages of beetles, so ably pursued by the talented Dane whose recent decease is still a matter of general regret amongst entomologists. The structural diagrams II. and III. on Plate A are, as given, far from being successful. They are described as representing the under-skeleton, but, actually, one-half of each of the diagrams represents the upper surface, and the manner in which the two halves are connected will inevitably suggest to a beginner that the structures displayed are those that would be seen on removing the parts covering the upper surface.

Mr. Fowler, as we have already stated, has taken great pains to make himself acquainted with the modern authorities, and to render his work as interesting as the nature of the subject and its great extent will permit ; his efforts in these directions will no doubt be duly appreciated, and his work will, it may be hoped, find a place in the libraries of all our local museums, as well as on the bookshelves of the amateur. D. S.

BRITISH STALK-EYED CRUSTACEA AND SPIDERS

British Stalk-eyed Crustacea and Spiders. By F. A. A. Skuse. (London: Swan Sonnenschein, Lowrey, and Co., 1886.)

THIS is a modest little volume of 126 pages, professedly written for the "tyro." We are informed, on p. 14, that the "pages do not profess to be either scientific or in the least anything beyond the production of a humble admirer of Nature, and only intended to put the reader on the road to the investigation of the creatures written about." This being so, it would be unfair to judge the work from the stand-point of more special treatises, and we need do no more than comment upon the introduction of a somewhat antiquated system of classification and of minor errors which would be unpardonable in a work of greater pretensions.

The book is a clearly stated compilation, and is, so far as it goes, fairly accurate and up to date. There is, manifestly, little room for originality, and the reader must be prepared to find that most of the more pleasing passages—those dealing with the habits of the animals described—are, of necessity, quotations from earlier authors, references to whose works are in all cases given as footnotes.

The subject-matter is apportioned into nine chapters and an introduction, and it deals with methods and accessories as fully as with the animals themselves. Under the head of Development (Chapter III.) are to be found the facts of morphology and physiology which fall within the scope of the work. It is in this that the author is at his worst, and there is much here which stands in need of revision. We are told, in the introduction, that "the earliest known insects have been found in the Devonian, so probably there also existed spiders." Taking the context into consideration, it is surprising that the author should thus presuppose the discovery of Palæozoic spiders, and overlook that of Silurian scorpions and cockroaches, the former so well to his purpose.

"Big-tails," "Queer-tails," and "Little-tails" are renderings of *Macrura*, *Anomoura*, and *Brachyura* as unfortunate as they are unconventional.

The illustrations are good as a whole ; some are excellent, being faithful copies of standard figures. More spiders might be advantageously delineated, and exception must be taken to the wretchedly wooden drawings of crustacean larvæ, especially of the young lobsters (p. 27). For the latter the author would do well to substitute, should a second edition be demanded, the strikingly truthful drawings of Sars ("Om Hummerens postembryonale udvikling," Christiania, 1874), or, failing those, Kent's figures ("International Fisheries Exhibition Literature," vol. vi. "Conferences").

There is much truth in the author's assertion (p. 10) that "everybody knows a crab. Everybody knows a spider. But it is just these every-day things that people know really least about ; while, on the contrary, things that must be sought for in order to be seen are often most commonly known." The writer is true to this tenet, and his book ought, in the hands of an intelligent "tyro," to be productive of good results ; while passages such as that in which he describes (p. 73) the construction of the spider's web are well calculated to arouse that enthusiasm which he is sanguine enough to presuppose. The appreciation of the beautiful in Nature must precede the devotion to that which is more useful, and the little handbook before us, invested, as it is throughout, with a true dignity of purpose, will serve as a means to this desired end.

OUR BOOK SHELF

Catalogue of the Fossil Mammalia in the British Museum, (Natural History) Cromwell Road, S.W. Part IV. Containing the Order Ungulata, Sub-order Proboscidea. By Richard Lydekker, B.A., F.G.S. (London : Printed by Order of the Trustees, 1886.)

THE collection of Proboscidean remains preserved in the British Museum is by far the largest in any Museum in the world ; containing as it does the splendid collections made in the Siwaliks of India by Sir Proby T. Cautley, the unrivalled British series of mammoth remains, the unique collection of pygmy-elephant remains from Malta, the series of remains of dinotherium and mastodon, from Eppelsheim, &c., and a fine collection of American mastodons from the United States and from South America.

An immense collection like this, containing remains belonging to nearly all the described forms, was admirably adapted for the study of transition forms, and Mr. Lydekker has not been content in this Catalogue with giving merely a detailed enumeration of the contents of the cases, but has written a full account of the families, genera, and most of the species of the known extinct Proboscidea. In a short introduction he gives some most interesting notes on the geographical and geological distribution of the species. In reference to the subject of the structure of the cheek-teeth Mr. Lydekker thinks that this can be

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traced from the most generalised to the most specialised member of the Elephantidæ. So complete indeed is this transition that not only is there no real line of demarcation between Mastodon and Elephas, but several of the species of the two genera seem to pass so imperceptibly into one another that it is not unfrequently a matter of extreme difficulty (if indeed it be not an absolute impossibility) to determine to which species individual teeth really belong.

In regard to geographical distribution, there appears to be considerable evidence in favour of an easterly migration of the mastodons having taken place from Europe to India; while the restriction of the stegodont group of elephants to the latter country and the regions to the eastward, points to the conclusion that the transition from the mastodons to the higher elephants took place in those regions. From this we may also infer that there subsequently ensued a westerly migration of these higher forms to Europe, and finally on to North America, where the true elephants did not make their appearance till the Pleistocene, and then appear to have been represented only by two species, one of which ranged over the greater part of the higher latitudes of the northern hemisphere. The descriptive details are very usefully illustrated by a number of woodcuts of the teeth and cranial bones. The work, despite its name of Catalogue, is a most important contribution to our knowledge of the subject.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

Iridescent Clouds

THIS phenomenon is very common here in the winter, occurring, with few exceptions, whenever there are scattered clouds near the sun. The colours are often brilliant enough to catch the attention of the most casual observer, but at other times they can only be made out with the aid of dark neutral-tint spectacles. These reduce the intensity of the glare near the sun to a point favourable to the discrimination of colour.

I have lately been watching the somewhat complicated phenomena, and taking rough measures of the angular distances of the various colours from the sun, and I have little doubt that the colours are due to diffraction of light by fine particles of ice.

Within a circle, radius about 2°, the clouds are white, perhaps faintly tinged with blue; but it is difficult to observe a delicate shade of colour so near the sun. This circular space is surrounded by a ring of yellow or orange. The region of most vivid hues is comprised between 3° and 7°, the most striking being purple, blue, orange, green, and red. These are not arranged in rings, but are distributed over the thinner parts of a cloud in irregular patches. Beyond this region the only colours visible are green and red, becoming fainter as the distance from the sun is increased. I have detected them in three or four cases at a distance of 21°. At some distance from the sun the greens and reds are frequently arranged in bands parallel to the edge of the cloud, sometimes as many as three bands of each being visible. I have often seen a cloud completely encircled by bands, the impression given to the observer being that the colour depends on the thickness of the cloud. No doubt the real explanation is that the ice particles are larger in the interior of a cloud. We have thus two independent factors to determine the colour of a particular portion of cloud: the distance from the sun, and the average size of the particles. Near the sun slight variations of the former are more important, so we get a tolerably regular yellow ring. Far from the sun the variations of the latter have overwhelming influence, and we have bands along the edge of a cloud. At a medium distance, in the region of vivid colour, we have the two factors nearly equally powerful, and indescribable confusion as the general result.

On one occasion, when the edge of a large cloud passed almost through the sun, I noted down the colours in order along the edge, where the size of the particles would be tolerably uniform: white, yellow, red; blue, green, yellow, pink; green, faint red. This list consists evidently of three successive diffraction spectra, and it is in satisfactory agreement with a number of less complete series that I have obtained. The blue, however, is often replaced by a brilliant purple, due to the first and second spectra overlapping. Another method of discovering the true order of the colours is by watching the changing hues of a cloud approaching or leaving the sun. This tended to corroborate the list just given, but I could seldom trace more than two or three changes, so rapidly did the clouds grow or dwindle away. I noticed, indeed, that the more rapid the growth the more brilliant were the colours displayed. One interesting observation deserves special mention. A cloud showed faint colour at a great distance from the sun. It was edged with green, with red inside. As it approached the sun, the bands moved inwards, and red appeared on the edge, then green, then red, then green. The last tint was very undecided, and afterwards the whole cloud remained white. The inward motion of the bands showed that the inner particles were larger.

We now come to the question of the form of the diffracting particles. The form most favourable to diffraction is the sphere, as with a sphere the angle of diffraction for any given spectrum depends only on its diameter. Thus if a cloud be composed of spheres of uniform size, and be at the angular distance from the sun corresponding to the first spectrum for that size, each sphere will send its quota of light to the observer. Next to the sphere comes the circular cylinder. In order that a cylinder may send diffracted light to the observer, its axis must lie in or near the reflecting plane. By the reflecting plane I mean the plane of a mirror which would reflect sunlight to the observer. But, when this condition is satisfied, the angle of diffraction, corresponding to any particular spectrum, depends only on the diameter of the cylinder. Any other form, a circular disk for instance, gives different diffracting angles according to the orientation of the particle. The spectra corresponding to different orientations would be superimposed and white light be the result.

Now, among the manifold forms of snow-crystals there is, I believe, nothing approximating to a sphere. But thin hexagonal prisms are common, either separate, or attached as rays to hexagonal disks. These would produce much the same effect as circular cylinders; for the extreme variation of the apparent diameter of an hexagonal prism from its mean value is only 7 per cent.

Granted that the diffracting particles are hexagonal filaments, my measurements of the angular distances of the colours from the sun supply data for determining the average diameter of the filaments. For this purpose purple is a useful colour, as it always arises from the overlapping of the first two spectra. I took some five-and-twenty measures at various times, which varied from 3½° to 6¾°. These give diameters from ·017 mm. to ·009 mm. Orange of the first spectrum ranged from 2½° to 5½°, six measures. These give diameters from ·021 mm. to ·010 mm. Blues of the second spectrum, four measures, 4½° to 6¾°; diameters ·014 mm. to ·009 mm. If the colours I observed at 21° from the sun were produced by filaments ·013 mm. in diameter, they must have belonged to the ninth spectrum. But the ninth spectrum, in addition to being only one-fortieth as bright as the first, is overlapped by four spectra of higher order and three of lower, so it can hardly be distinguishable. At such a distance from the sun the finer particles would have a great advantage in colour-producing power, so I think it probable the spectrum was of the fifth order, produced by particles of diameter ·009 mm.

The next difficulty is to explain why colours are not seen in clouds composed of minute spheres of water. As explained before, the spherical form has a great advantage. I find by calculation that if the spheres were of uniform size, diameter ·013 mm., the colours of the first spectrum would be about twenty times as brilliant as if the cloud were composed of filaments of the same diameter, arranged at random, but occupying the same fraction of the field of view. So we might *a priori* expect that water clouds would be more brightly iridescent than ice clouds. But it is not so. During the summer here I looked frequently and vainly for iridescence. This want of colour must arise from the minute drops not attaining sufficient uniformity of size. So we have to find some cause of uniformity which acts

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